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Kirin To Use Biotechnology To Increase Seed Business

43073903 Tokyo JAPAN CHEMICAL WEEK in English 23 Mar 89 p 4

[Text] Kirin Brewery Co. intends to build up its setup for deploying seed-and-seedling operations by means of biotechnology to such an extent that annual sales of this line will reach ¥30 billion by the year 2001.

Kirin, Japan's top beer brewer, is branching out into flower business. In 1986 it established Flower Gate Inc., an equally owned joint venture for flower sales in Japan, and in 1988 it obtained a 30 percent stake in Twyford International Corp., a U.S. firm specialized chiefly in tissue cultivation for plants with beautiful leaves.

Twyford has taken over Hartmans Plants Laboratories, Inc. (U.S.) and now holds one fourth of the U.S. markets for such plants.

Kirin earned last year ¥700 million from flower business here and hopes to chalk up ¥1 billion this year. It is extending the application of tissue cultivation from flowers to vegetables and cereals, and is trying to arrange an international business setup so that new varieties of plants to be developed by Kirin and its partners will be simultaneously marketed in Japan, the U.S. and Europe.

The company has started business in mass cultivation of plants by tissue culture on a commission basis. It is also prepared to undertake joint business with Western firms with regard to potato cultivation.

It is now reviewing varieties of seeds to be artificially modified so as to select those which will be widely accepted yet difficult to mass culture, and which will also be commercially viable. Company officials remark that the theme to be tackled from now on is how to impart target modified seeds with long-term preservability and the high germination yield the native seeds have.

Matsushita Develops 16-MB Floppy Disk Drive

3698A044 Chichester INTERNATIONAL TELECOMMUNICATIONS INTELLIGENCE in English 9 Dec 88 p 8

[Article: "Matsushita Develops 16-Megabyte Floppy Disk Drive System"]

[Text] The Memory Systems Division of Matsushita Electrical Industrial Co., Ltd. has developed a floppy disk drive system that can store up to 16 megabytes of data on a standard-sized 3.5-inch floppy disk. It has a linear recording density of 35,000 bits per inch and uses 542 tracks per inch, providing 640 tracks on either side of the disk. To attain such high data densities reliably, Matsushita developed a special metal-coated disk. Samples will be available "early in 1989, and mass production will start in April next year," according to a spokesman.

Weapons Manufacturers Making Comeback

The Japan Steel Works

43062063 Tokyo ZAIKEI TENBO in Japanese Jan 89 pp 144-146

[Excerpt] [Passage omitted] Revival of Established Defense Manufacturers? Japan Steel Works, the Manufacturer of the Guns for Battleship "Yamato": Is Its Power a Thing of the Past?

Before the war, Japan Steel Works was known as a representative Japanese weapons manufacturer, but that brilliance now is gone. In the current thaw in defense production, what sort of weapon of the future is Japan Steel Works designing in secret to rise above its present status of small arms manufacturer?

Course of Japan Steel Works (Weapons Sector)

- November 1907: Formed as joint venture by Hokkaido Mining and Steamship, Armstrong and Vickers. Began gun barrel and other weapons production.
- November 1945: With end of Pacific War, removed weapons and ammunition production from articles of incorporation.
- December 1945 - August 1946: Began production of civilian goods.
- January 1949: Established Akabane workshop for special procurement work (repairs for U.S. Forces).
- December 1950: In accordance with Business Reconstruction and Adjustment Law, changed company name to Old Japan Steel Works, Inc., and liquidated company; then newly established Japan Steel Works, Inc.
- May 1953: Revised articles of incorporation and reinstated weapons, ammunition, rolling stock, ships, and parts thereof as business objectives.
- August 1953: Under Weapons Manufacturing Law, designated as Japan's sole manufacturer of guns.
- April 1956: Plant exclusively for small arms completed in Hiroshima.
- February 1979: Special equipment main office established.
- April 1988: In special equipment main office, separate departments were set up for sale of special equipment to GSDF, ASDF, and MSDF, as well as executive department for special equipment planning and special equipment systems promotion department.

First, Nissan Motors and Ishikawajima-Harima Heavy Industries added a weapons section to their articles of incorporation. Then, in September, the Japan Defense Equipment Industrial Association realized its longstanding dream of incorporation.

This association is the successor of the prewar Japan Ordnance Association. It was revived in 1952 as the weapons production cooperative (and then changed its name to the Japan Ordnance Association in 1953). The association now is recognized formally as a group under the joint jurisdiction of the Japanese Defense Agency (JDA) and the Ministry of International Trade and Industry (MITI). It is the first industrial association since the war to fall under JDA's jurisdiction. It is said that Japan Steel Works contributed greatly to the incorporation of the association.

The Legend of Ishizuka and the Battleship "Yamato"

Stockbrokers call Japan Steel Works the "arm" company because it was formed in 1871 as a joint venture between the Hokkaido mining and steamship company and two British firms, Vickers and Armstrong. Before the war, it produced field artillery such as antiaircraft guns, tank guns and warship mounted guns, as well as small arms such as machine guns and ammunition. It was known as a weapons manufacturer equal to Mitsubishi Heavy Industries.

Moreover, Japan Steel Works was known to have made the principal guns (46 cm guns) of the battleships "Yamato" and "Musashi," said to be the most powerful in the world at the time. It was the top company in the prewar weapons industry.

Because military secret documents were burned during the last days of the Pacific war, there is no absolute proof about the manufacturing of the principal guns of the "Yamato" and the "Musashi." However, people in Japan Steel Works believe a legend that the guns were manufactured in 1940 with a 10,000 ton press that was operating in the company's plant in Muroran.

There is another legend as well, the legend of Kumezo Ishizuka (died in 1962). Ishizuka was appointed president of Japan Steel Works shortly after the war, and then, after retiring to become chairman, was brought back again as president to replace Tetsuji Aratani, who resigned to take responsibility for a labor dispute of historical proportion at the Muroran plant. Ishizuka poured his energies into switching the company over to private control and reviving it as a weapons manufacturer in the turmoil-filled period after the war, and he was one of the firm's great presidents of which Japan Steel Works is proud.

Also, the aforementioned prewar Japan Ordnance Association actually was established through the advocacy of Ishizuka, who was managing director of Japan Steel Works at the time (1940) and Kiyoshi Goko, managing director of Mitsubishi Heavy Industries. After the war, the first chairman of the revived association was Goko, and the second was Ishizuka. One person who knew Ishizuka is Masuzo Kimura, a director in the standing committee of the Japan Defense Equipment Industrial Association, and he puts it this way: "After Ishizuka, the post of association chairman always has been filled by people who served in the post as representatives of member companies. Ishizuka and Goko were different; they served as individuals. That is how powerful they were in the industry."

Guns Often Viewed As "Old-fashioned Weapons"

These two legends illustrate the power of Japan Steel Works at the time. Since 1983, however, it has held seventh place in amount contracted from JDA (see chart below). It is content with the perennial status of a manufacturer of medium standing, and has lost its old brilliance.

Top 15 JDA Contractors for FY87

Rank	Company	Contract Value (million yen)	Percent of JDA Annual Procurement
1	Mitsubishi Heavy Industries	262,475	20.6
2	Kawasaki Heavy Industries	171,420	13.5
3	Mitsubishi Electric	86,523	6.8
4	Ishikawajima-Harima Heavy Industries	75,089	5.9
5	Toshiba Corporation	72,707	5.7
6	NEC Corporation	60,717	4.8
7	Japan Steel Works	24,336	1.9
8	Fujitsu Ltd.	22,273	1.8
9	Komatsu Ltd.	21,122	1.7
10	Hitachi Zosen Corporation	20,913	1.6
11	Fuji Heavy Industries	20,213	1.6
12	Oki Electric Industry	16,528	1.3
13	Sumitomo Heavy Industries	15,818	1.2
14	Mitsubishi Corporation	14,662	1.2
15	Mitsui Engineering and Shipbuilding	13,762	1.1

Former JDA Uniformed Officers Who Have Joined Japan Steel Works (Since 1983)

Current Position	Name	Last Rank in JDA
Advisor	Tatsuji Kuyama	GSDF Lt. General (LTGEN)
Advisor	Hiroshi Takeda	GSDF LTGEN
Consultant	Tsutomu Hagiwara	GSDF Maj. General (MGEN)
Consultant	Yosuke Shiraishi	MSDF Rear Admiral (RADM)

A newsman who covers JDA says, "There is interest in aircraft manufacturers, but there is nothing new or interesting about firearm and ammunition manufacturers."

Japan Steel Works is Japan's only manufacturer of large and medium bore firearms. It produces guns such as the 74-type tank gun, the FH70 203 mm self-propelled howitzer, and a new antiaircraft machine gun, but these are haunted by the image of being "old-fashioned weapons." Actually, it is said that at a manufacturing plant (the Hiroshima plant), work that is very close to handwork is done to make thin, long gun barrels from material sent from the Muroran plant. The current rate of switchover to NC (numerically controlled machine tools) in firearm plants is about 50 percent.

"In 1990, the rate of switchover to NC will be raised to 70 percent," says Yoshitaka Yoshida, director and head of the main office for special equipment. On the other hand, Koji Nemoto, the assistant head in charge of technology, says that "There are some parts that must be made by hand, due to the special nature of small arms." Furthermore, compared to other ultramodern weapons, the unit price of small arms is relatively low, and it is difficult to say that there would be much profit for Japan Steel Works after making down payments to electronic equipment manufacturers.

Besides, about 90 percent of the company's sales in FY87 (Y24,336 million) were related to the Ground Self Defense Force (GSDF), while only 9 percent involved the Marine Self Defense Force (MSDF) and a mere 1 percent was related to the Air Self Defense Force (ASDF). One of the concerns borne by Japan Steel Works is that it does not want to have to eat losses because of a bias favoring ASDF and MSDF.

On top of that, it has been difficult to say that the company's business acumen has been strong. The flamboyant competition growing among aircraft manufacturers has been so fierce that there even have been human casualties, according to the newsman who covers JDA.

In contrast, according to Yoshida, the business operations of Japan Steel Works, Japan's only manufacturer of firearms, used to be "passive in some ways, frankly. We only started moving when JDA's budget was set."

Circumstances have changed completely, however. Now, the United States and other advanced countries have started to refuse to provide advanced weapons technology, even for a fee, and hereafter, Japan Steel Works will be in competition with foreign weapons manufacturers who used to be its partners.

What Weapon of the Future Is Being Designed to Revive the Company?

The steel sector, the main business of Japan Steel Works, has stagnated and the company has halved the production capacity of its Muroran plant. Thus the defense sector accounts for a high proportion of its business, about 24 percent. Because of this, a management goal is to "diversify, using as a springboard the weapons sector, which requires the most advanced technology," says Yoshida. With the thaw in defense production, the company is faced with the need to forge a plan for strengthening its weapons section.

Wide-reaching structural reforms were implemented in April 1989 (as in text) as a part of that plan. In the special equipment main office (defense section) were established an executive department for special equipment planning, separate special equipment sales departments for ground, air and marine sectors, and a special equipment systems promotion department. The goals are to beef up MSDF and ASDF sales, thoroughly revamp sales structure and improve service.

Masanori Ueki, assistant head of the main office in charge of sales, puts it another way: "We will proceed with research on our own so that we can get a share of equipment R&D before it is budgeted by JDA, and conversely, we will create an organization that can propose equipment improvements to JDA." The company is moving in a completely new direction. Also, in December 1985, the company established Nikko Tokki to supply parts and provide aftercare services. In 1985, preceding these organizational improvements, the company already had expanded its electronics research facilities. In the short term, it will work on improving the performance as well as reducing the weight and size of existing equipment, but in the long and medium term, based on its record of having produced the GMLS-3 missile launcher, it appears to be eying the contract for a domestically developed missile, which is a plum in the next 5-year mid-term defense plan.

Apart from that, however, the company's research section secretly is developing a super-advanced new weapon in order to get away from the perception of being a manufacturer of old-fashioned weapons.

This new weapon is an "electromagnetic gun," which GSDF expects to be a Twenty-first Century weapon and which is the ground combat version of the SDI (Strategic Defense Initiative) promoted by the United States. SDI refers to shooting down ICBMs (intercontinental ballistic missiles) by laser or particle beams, rockets, or electromagnetically accelerated rail guns. The "electromagnetic gun" uses the rail gun concept. At present, the question of whether funding for electromagnetic gun R&D should be included in the next defense plan is being considered, so actual application is a matter for the future. Nevertheless, more than 10 domestic weapons manufacturers are eager to get the contract for the accelerator, which can be said to be the heart of the electromagnetic gun. Japan Steel Works, too, is confident, as is shown by Yoshida's comment that "apart from the accelerator, the electromagnetic gun will have to be manufactured by us because we are the gun barrel manufacturer." Will R&D on rockets and the electromagnetic gun free Japan Steel Works from the "old-fashioned weapons" label?

Fuji Heavy Industries

43062063 Tokyo ZAIKEI TENBO in Japanese Feb 89 pp 120-123

[Excerpt][Passage omitted] Revival of Established Defense Manufacturers? Fuji Heavy Industries Aims At Next Generation Support Fighter (FSX)

Fuji Heavy Industries (FHI) originated from Nakajima Aircraft Company, maker of the famous prewar aircraft, "Hayabusa." Criticized behind its back by main wing manufacturers, when will FHI again become a "sky ace" with the world's finest composite materials technology?

Course of FHI (Aircraft Sector)

- 1917: Chikubei Nakajima built the aircraft research laboratory in Gunma Prefecture.
- 1931: Company name changed to Nakajima Aircraft.
- 1941-1944: Series of Nakajima's aircraft, including "Hayabusa" and "Shippu," adopted as regulation equipment.
- April 1945: Nakajima became state-controlled first munitions arsenal.
- August 1945: When cessation of war declared, Nakajima ordered to halt production. Company name changed to Fuji Industry, articles of incorporation revised and company converted to peacetime production.
- July 1953: Fuji Heavy Industries formed from merger of five of Fuji Industry's secondary firms.
- November 1953: Assembly began on T-34 elementary training aircraft.
- January 1958: Maiden flight of first jet aircraft produced in Japan (T1 intermediate trainer) was successful.
- August 1965: Maiden flight of FA-200 Aerosubaru (civil aircraft), first light aircraft produced in Japan after the war.

- October 1965: Aircraft business department launched.
- March 1967: FTB, a VTOL (vertical takeoff and landing) aircraft, completed.
- June 1971: "Firebee" high-speed target drone completed.
- December 1979: In winning the order for experimental production and research on RPV (remotely piloted vehicle) unmanned reconnaissance aircraft, gained superiority in unmanned aircraft sector.
- September 1981: By losing competition for T4 (intermediate trainer) contract, said to have been eliminated from the fixed wing aircraft sector.
- May 1982: Established status as helicopter manufacturer through designation as prime contractor for AH-15 antitank helicopter for GSDF.
- July 1983: Designated developer of target drones.

Former Self Defense Forces (SDF) Uniformed Officials Who Have Joined FHI (As of December 1988)

Current Position	Name	Last Rank/Position in SDF	Date Joined FHI
Advisor	Tadao Kawano	RADM; Commander (Cmdr), MSDF Fleet Air Wing 4	1 Apr 1980
Advisor	Shigehiko Kawagoe	LTGEN; Cmdr, ASDF Flying Training Command	1 Sep 1980
Advisor	Kazuaki Takatsu	MGEN; Commandant, GSDF Flight School, Kasumigaura Branch	1 Jan 1982
Advisor	Akira Niino	LTGEN; Cmdr, ASDF Air Traffic Control and Weather Wing	1 May 1984
Advisor	Shoji Kobayashi	LTGEN, GSDF; Commandant, Joint Staff College	1 Sep 1984
Advisor	Koichi Mitsui	———; Deputy Director-General, Central Procurement Office	1 Dec 1985
Advisor	Takashi Hamada	LTGEN, ASDF; Technical Development Officer, Technical Research and Development Institute	1 Mar 1987
Advisor	Makoto Suzuki	LTGEN; Commandant, ASDF Officer Candidate School	1 May 1987

Originally, Japan planned to develop the FSX domestically. However, after "political negotiations," it was decided that Japan and the United States would co-develop the FSX using the F16 of GD (General Dynamics) as a model. Subsequently, private level negotiations stalled on the question of what parts each side would produce. Regarding the main wing, which had become the focus of the dispute, JDA declared that "It is appropriate for the development to be led by Japan," and it set out to persuade the U.S. side. According to a concerned party, however, "Because GD's attitude is hardline, nothing has been decided as yet about which side will handle the main wing."

If the Japanese side is declared the winner, Mitsubishi Heavy Industries, which has been designated the prime contractor, naturally will have the best chance, but FHI, which is said to have a slight lead technologically, apparently also has a chance.

"Restore the Tradition of Nakajima" Is a Prime Directive

As is well known, FHI is a descendant of the Nakajima Aircraft Company which was known as a "sky ace" equal to Mitsubishi. It produced the "Sakae engine" which was mounted on the zero fighter; the army's famous fighters "Hayabusa" and "Shippu;" and the "Gekko," a "97 type ship-board" night fighter that participated in the attack on Pearl Harbor. Additionally, it participated in the planning and development of the "Fugaku" super-heavy bomber, which was said to have been the secret plan for reviving the Japanese forces. During the war, it was the second largest producer of engines and the first in aircraft body production, effectively splitting the aircraft industry of the time with Mitsubishi.

After the war, when Nakajima Aircraft became FHI, it built up its status as a training aircraft manufacturer. First, it engaged in mass production of the T34 trainer, and then in 1958, it succeeded in building the T1 intermediate trainer, the first jet to be produced domestically.

It seems that at the time, many technicians joined FHI because of their attachment to Nakajima Aircraft. The current head of the aircraft technology main office in FHI's Utsunomiya plant, Managing Director Ken Makino, is one of them. He says, "I received my training from the chief developer of the 'Shippu.' The technological tradition of the Nakajima era is being passed on today."

However, FHI, which built up its status as a training aircraft manufacturer by developing the T1, was defeated in the competition for the MTX (next generation intermediate trainer) contract. Thus, it was said that FHI had been pushed out of the fixed wing aircraft sector. Although it made up for this by strengthening its position as a helicopter manufacturer, it often was criticized behind its back by "main wing manufacturers" because it shared production of the main wing for domestically produced aircraft such as the F-1 support fighter, the T4 (production model of the MTX) intermediate trainer, the C-1 transporter, and the PS-1 antisubmarine seaplane.

In particular, FHI fought furiously with two other aircraft manufacturers, Mitsubishi and Kawasaki Heavy Industries, to win the prime contract for the MTX. At an early stage, FHI had established the MTX as a company project and was rumored to be the leading candidate. When the prime contract was awarded, however, it went to Kawasaki. FHI and Mitsubishi got 30 percent production workshares. Defeat over the MTX was a major blow to FHI, as reflected in the comment of a rival firm that "It seems that failure to get the prime contract has eliminated FHI from the fixed wing aircraft sector."

FHI had ¥20,213 million in contracts with JDA in FY87, which put it in 11th place. This increases to ¥33,200 million (61 percent GSDF, 23 percent ASDF and 14 percent MSDF) when contracts for partial work in projects are included, but it only puts FHI above Japan Steel Works (in seventh place), which was taken up in an article in the previous issue of this journal; there is still a large gap between FHI and first-place holder Mitsubishi.

The company has absolute confidence in its technological capability, but its style, including its automobile section, is solid and steady. The flair of the Nakajima era is gone.

This flair of FHI's ancestor probably is behind the fact that President Toshihiro Tajima, who came to FHI from the Industrial Bank of Japan, always exhorts employees to "revive the Nakajima tradition" whenever anything happens.

Led by President Tajima, who is known to be a "gadget freak," FHI is pushing toward recovering the reputation of "the racing Subaru" and "the sky ace." The company's aircraft business department in particular is in the frontline of the battle, and is eager to restore its status in the fixed wing aircraft sector, which was lost in the MTX contract competition.

This may be the biggest motive behind FHI's determination to get the contract for the main wing of the FSX.

Why the Determination to Win the FSX Contract

At this point, the matter of composite materials must be addressed.

At one time, a composite material known as FRP (carbon fiber reinforced plastic) drew attention as a new material that would replace plastic.

The first to be interested was the aircraft industry, because this material's "lightweight and solid" qualities were essential to aircraft development. Especially since composite material absorbs radar, it is exactly the right material for aircraft that must have stealth (invisible to radar) capability.

Composite material was first used for helicopters, but now it also is used in aircraft primary structure, such as for fairing and vertical tails.

However, composite material does have a flaw, the fact that it is strong vertically, but weak horizontally. An aircraft is subjected to stress from different directions during takeoff, flight and landing. Therefore, many thin sheets of composite material must be layered in varying directions to make up for its weakness. The technology for this, composite material bonding, consists of a laminator which layers the sheets and an autoclave furnace in which the material is formed.

Says Makino: "The sheets are laminated precisely according to design, not stuck together haphazardly. The design must take into account all forms of stress. This is extremely difficult, but FHI has mastered the technology through years of research and mass production."

Essentially, this means that unless the material is designed precisely, the aircraft will fall apart in midflight.

FHI produced an experimental vertical tail for the T2 (advanced trainer), and for the T4, it succeeded in the first Japanese mass production of a vertical tail, thereby becoming the leader in this field.

However, composite material has another major flaw.

A concerned party says, "Although there are cases where composite material is used for parts such as the vertical tail, it cannot be used for the principal structure, such as the fuselage, because it still has a long way to go in terms of cost performance." That is, composite material is expensive.

To resolve that problem, a complicated technology called "co-curing" is necessary. This co-curing technology is the key to making composite material, which is said to have very poor cost performance as yet, into a material that is as commonly used as metal.

FHI is so confident of this technology that Makino says, with self-satisfaction, "We are one step ahead of other firms." With the FSX in mind, the company began research in the technological research institute in its Utsunomiya plant in 1985, and already has succeeded in applying the technology.

Technical journal writers say that FHI will rise in the area of composite materials in the future. For the company, this means that it would like to use its composite material technology to launch a major assault on the fixed wing aircraft sector from which it had been forced out. Composite material has never been used for the main wing of a domestic aircraft, and the company could establish an international reputation as "FHI of composite material" if it could win the contract for the main

wing of the FSX, which is of great interest to the news media. Plus this would be a way to strike back at main wing manufacturers for their spiteful comments.

If composite materials are used in the principal structure of aircraft in the future, the day may come when FHI eclipses Mitsubishi as an aircraft manufacturer.

However, FHI's rivals, GD of the United States and Mitsubishi, also are very confident of their own composite material technology.

GD became interested in the FSX project only because it was said that composite material will be used for the main wing. Mitsubishi conducted joint research on co-curing technology with JDA's Third Research Institute from 1982 to 1987 (FHI also participated as a subcontractor). Moreover, it is Mitsubishi who currently is negotiating with the U.S. side on main wing production.

A party who knows all the details of the situation says, "FHI may have the technological capability, but Mitsubishi is stronger in terms of political clout and the role it has played in the project thus far."

Naturally, this is a matter to be determined after a decision is made that the Japanese side will produce the main wing. Currently, this is being negotiated between Japan and the United States. Whether it will work out as FHI desires cannot be predicted at all.

To recover its position in the fixed wing aircraft sector, FHI must conquer the hurdle of the ATX (next generation advanced trainer) as well as the FSX. The contract for the successor to the T2 advanced trainer is certain to exceed that of the MTX, which was said to have been ¥300 billion or even ¥400 billion, and it is inevitable that there will be another dogfight in midair among Mitsubishi, Kawasaki and Fuji.

Yasuyuki Kogure, managing director and deputy head of FHI's aircraft business department, expresses FHI's ambitions thus: "For trainers, FHI was prime contractor for the T1, Mitsubishi got the T2, and Kawasaki got the T4. One round is over, and the next should go to FHI."

However, Mitsubishi currently is producing the T2, and it is difficult to say whether things will go as FHI expects.

Winning Contract for AHX (Next Generation Antitank Helicopter) Is Life Or Death Issue for FHI

On top of that, FHI faces another ordeal that may cause it to lose its footing.

As stated above, 61 percent of FHI's FY87 defense sales were to GSDF. In the helicopter sector, it is "Mitsubishi of MSDF" and "FHI of GSDF," which indicates that helicopter sales to GSDF is FHI's lifeblood. Currently, FHI is supplying Bell AH-1S antitank helicopters and Bell HU-1H multipurpose helicopters. Sale of the AH-1S in particular accounts for one-fourth of the sales of the aircraft business department, and is the company's dollar cashbox.

By the end of FY88, GSDF will introduce 40 of the AH-1S, Japan's only antitank helicopter. Thirty-two already have been deployed with the antitank helicopter units in Obihiro and Hachinohe. The AH-1S is equipped with antitank missiles, 70 mm rockets, and rotating 30 mm machine guns, but GSDF recently firmed up the policy of procuring helicopters with increased firepower to succeed the AH-1S. Equipment type will be set in the next defense plan, but for the present, GSDF is eying the AH64 Apache of the Hughes Corporation (absorbed into Macdonell Douglas). In that event, Kawasaki Heavy Industries, which has ties with Hughes, will have a chance to get the contract.

After having been pushed out of the trainer sector by the defeat over the MTX, if FHI loses the AHX contract, restoring its position as "sky ace" will no longer be a concern because its aircraft business division will fall apart in midair.

Kawasaki's position is "no comment" right now, but FHI (Kogure) insists, "Acquisition of the AHX is a life or death issue. This is one thing that we cannot concede to other firms. We are the only domestic manufacturer of antitank helicopters and no other firm has accumulated the technology that we have. Therefore, from the viewpoint of defense capability as well, it is desirable that we produce the AHX." In fact, it is rumored that FHI already has started lobbying behind the scenes.

Moreover, in the multipurpose helicopter sector, Mitsubishi has offered to GSDF the Sikorsky UH-60, which it supplies to MSDF and ASDF. FHI has made an opposing offer of an improved version of the HU-1H, so a dogfight with Mitsubishi is expected in this sector as well.

Although FHI wants to improve its solid and steady style and "restore the Nakajima tradition," there are many hurdles it must surmount, and it appears that the path to becoming a "sky ace" is very steep.

Synchrotron Orbit Radiation Apparatus Developed

43070011 Tokyo KYODO in English
1027 GMT 30 Dec 88

[Text] Tokyo, Dec. 30, KYODO—Ishikawajima-Harima Heavy Industries Co. (IHI) has developed a synchrotron orbit radiation (SOR) beam generator for use in the manufacture of next-generation ultra-large-scale integrated circuit chips (ULSIS), IHI officials said Friday.

The major shipbuilder, known for its technological expertise in electronics fields, will start marketing the new beam generator from the latter half of 1989, the officials said.

The apparatus will be used in combination with an x-ray lithograph LSI etching technique and will open the way for the development of 64-megabit computer memory chips.

Such extremely high levels of integration require a high-precision etching technique to carve circuit lines with widths of only 0.25 micron to 0.3 micron, the officials said.

Research institutes and electronics corporations from Japan, the European Community (EC), and the United States have been engaged in an intensive race to develop a SOR beam generator for the manufacture of ULSI computer chips.

Synchrotron orbit radiation is a powerful, sharply-convergent electromagnetic beam emitted from a synchrotron. The beam is tangential, like a rapidly rotating drenched umbrella shooting a stream of rain drops from its rim.

Synchrotrons are circular apparatus for imparting very high speed electrons in a strong electromagnetic field.

The Japanese market for SOR beam generators alone is expected to expand to some ¥100 billion by the latter half of 1990s, when semiconductor makers are expected to kick off full-fledged manufacturing of 64-megabit memory chips, they said.

IHI's SOR beam generator, dubbed "luna," comprises an 8-meter-long linear electron preliminary accelerator, a 6.7-meter-diameter synchrotron and 20 beam guides for extracting SOR beams from the synchrotron's stream of revolving charged electrons.

IHI plans to install the complex apparatus at a laboratory at the hamlet of Dejima in Ibaraki Prefecture by the end of next January, and complete a series of tests to confirm its capabilities by the summer of 1989, the officials said.

Meanwhile, Sumitomo Heavy Industries Ltd. said it is also developing an SOR beam generator that will use superconducting electromagnets in its synchrotron.

The inclusion of superconducting electromagnets will reduce the necessary diameter of the synchrotron to only 3 meters, Sumitomo officials said. The Sumitomo machine is dubbed "aurora."

Sumitomo wants to hold the price of the basic apparatus below ¥2 billion, while IHI is targetting the billion-and-a-half yen level, according to officials of the two firms.

The two companies are also considering applying their SOR beam generators to uses in the medical field and to analytical research on the molecular structure of substances, they said.

Technology Development Plan for Materials discussed

43062038a Tokyo PUROMETEUSU in Japanese Oct 88 pp 38-41

[Article by Technology Development Division, Atomic Energy Bureau, Science and Technology Agency: "Technology Development Plan for Materials Used in Nuclear Energy" (number 10 in series "Atomic Energy—Leading Edge, Atomic Energy Basic Research")]

[Text] In the "Long-term Plan For Development and Utilization of Atomic Energy" which was devised some time ago (June 1987; Atomic Energy Commission), there is set forth the policy that future R&D will emphasize the creative, innovative domain called the frontier of atomic energy, which by such means as searching for germs of technology and accumulating systematic R&D, brings about major technological innovation, from which, in turn, a ripple effect on science and technology in general is anticipated, and will promote basic technology which joins together basic research and project development. Within this we have taken up materials technology for atomic energy use, artificial intelligence technology for atomic energy use, laser technology for atomic energy use and technology for evaluation and reduction of radiation risk as technological domains which share to a great degree a common foundation, and we will make it a practice to promote future development of these technologies in an efficient and planned manner under the cooperation of industry, academia and government. Here, from among these technologies, we shall discuss development of basic technology concerning materials used in atomic energy.

1. Present Status and New Direction of R&D on Materials Used in Atomic Energy

Research and development on atomic-energy use materials up to now has been promoted mainly on the so-called "vertical split model" of development of limited element technology in order to quickly achieve goals within a strategy of separate development by the reactor types of light water reactors, high-speed breeding reactors and nuclear fusion reactors. Furthermore, R&D is being conducted based on the respective principles and necessities of atomic-energy related research corporations, national research institutes, universities and the private sector. At atomic-energy related research corporations and in the private sector, the R&D being conducted is mainly in line with project necessity. On the other hand, at national research institutes and universities, ordinarily, basic research aimed at elucidating the behavior of materials is being carried out.

The special characteristic of development of materials technology is that it is something which becomes the key to all science and technology, and at the same time, the technology which is developed possesses the ripple effect of bringing about technological innovation in other fields. Consequently, it can be said that the materials technology of every kind of field is, by nature, "basic technology" in the sense that it becomes a driving force which fulfills the role of leading technological development as a whole. In recent years, accompanying intensification of development among advanced countries, Japan, too, is being driven by necessity to free itself from the predisposition, like that up to now, to depend upon importation of technology, and develop independently new materials oriented toward higher and more diverse functions. Furthermore, as indicated in the "Long Term Plan for Development and Utilization of Atomic Energy," a creative, innovative type of research is desired in future R&D on materials for use in atomic energy, based on the fact that it will be R&D on common basic technology for the purpose of responding in a flexible manner to diversification and advancement of medium-and-long-term social needs, introducing leading-edge technology and promoting the creation of innovative technology. In addition, in order to conduct this kind of R&D in a comprehensive and efficient manner, it is important to make full use of the potential and technical knowledge which is accumulated in each research facility and to attempt an organic cooperation with them, while respecting the special characteristics and the independence of each facility. Therefore, along with attempting to promote international cooperation and the fostering of talented staff, it will be necessary to plan and coordinate research plans for the nation as a whole as needed.

2. R&D Tasks on Materials for Atomic-Energy Use

When one considers the common-base nature of atomic energy, the special characteristics of development of materials for atomic-energy use, the creative and innovative nature of the research and its character of influencing other fields, the research tasks which should be strongly promoted in the field of atomic-energy use materials are as follows. Furthermore, the tasks taken up here are things which will be reviewed in an appropriate manner accompanying progress in the development of technology and changes in the general state of things. Moreover, the following tasks can be divided roughly into R&D concerned with creating new atomic-energy use materials and shedding light on their structures ((1) to (3)) and R&D concerning the advancement of analysis and evaluation technology and R&D concerning data bases for materials-design as things which give a direction to the development of new materials ((4) and (5)), and they are in a mutually complementary relationship.

(1) R&D on Radiation-Resistant Materials

The development of radiation-resistant materials is an indispensable task in connection with promoting such things as advancement of high-speed reactors and development of nuclear-fusion reactors. At present, in project research, development of structural materials is being carried out centered on steel materials, but here, adopting a more medium-to-long-term viewpoint, we will

promote development of radiation-resistant new structural materials with the aim of actively improving such mechanical properties as deterioration due to radiation damage. Therefore, we shall carry out material design based on irradiation modeling and computer simulation experiments and create materials with superior radiation and heat resistance, such as huge single crystals of high-melting-point metal etc., metal compounds, ceramics and composite materials of these. Here such things as the advance of surface-transformation technology, functionally gradient material technology and junction technology are required as compounding technology.

In the future greater emphasis will be placed not only on structural materials, but also on new-function radiation-resistant materials whose purpose will be the improvement of deterioration in functional features. Here, along with creating semiconductors which can operate in a high-termperature heavy-irradiation environment, we will do such things as assessing the basic features of semiconductors and elucidating the structure of radiation damage and the recovery process thereof. Furthermore, we shall create an intelligent (temperature, pressure, radiation etc.) ceramic composite material that can withstand heavy irradiation.

In the future we will also promote investigation concerning development of new materials using neutron irradiation.

(2) Development of Materials for the Purpose of Reducing Radiation

Research and development for the purpose of reducing radiation is an indispensable task in order to utilize atomic energy as a safe system into the future and also in order to expand the fields in which atomic energy is used. Within this we will develop radiation-lowering materials designed to reduce the burden of the treatment, disposal and safe management of radioactive waste and high-performance shield material which will prevent radiation leakage and enhance the safety of atomic energy facilities.

In regard to development of radiation-lowering materials, we shall select the radiation-lowering elements, and design the materials which combine them, according to the neutron spectrum field based on calculation of the change to induced radiation. By this means we shall create such new materials as radiation-lowering metal materials with superior mechanical characteristics, ceramic and composite materials with a high degree of purity and abundant tenacity and radiation-lowering concrete, and will evaluate their basic characteristics and irradiation characteristics. Furthermore, in the future we will aim at development of radiation-lowering isotope material through introduction of isotope-separation technology.

In regard to development of high-performance shield material, we shall aim for development of material design in order to extract shield substances which possess a large absorption cross section for such things as high-speed neutrons and reducing penetrating radiation. Furthermore, along with developing new-type shield materials using porous ceramics and functionally gradient material technology, we shall attempt to upgrade the performance of shield materials by adding heat-resistance, pressure-resistance and so on.

(3) R&D Concerning Chemical Reaction and Control of Materials for Atomic-Energy Use

The harshness of the environments in which atomic-energy materials are used lies in the fact that added to the physical attack of radiation and so on, the material is invaded from its surface by chemical reactions. This kind of chemical interaction of atomic-energy-use materials under a complex hazardous environment is a task which is necessarily included in order to control atomic power safely and utilize its energy; in solving these problems an approach is needed which pays attention to the chemical reaction of the material in a radiation field and is based on a common chemical foundation for atomic-energy-use materials.

Therefore, first of all, an approach which begins with elucidation of each individual elementary process of the reaction is important. We measure in situ the elementary process of the reactions which take place in the atmosphere, which is extremely active chemically, and on the surface of the material, and attempt a physico-chemical elucidation. Parallel with this, along with gasping in phenomenological terms the action of material deterioration which is accelerated many times in the hazardous environment, we will carry out R&D in connection with technology for estimating radiation corrosion, erosion and corrosion. Based upon the above knowledge, and using technologies for controlling surface-structure and reforming, we shall promote development of materials which possess surface physico-chemical functions.

(4) Analysis/Assessment of Materials for Atomic-Energy Use and Development of Technology for Upgrading Reliability

The functions which are demanded of materials used in atomic energy have become more and more advanced. Analytical and systematic analysis and evaluation of materials at a micro level will begin to become vital for an accurate grasp of the behavior of the materials, decisions on the limits of their use, and also in order to obtain knowledge for developing new materials. Therefore, while adopting in an appropriate manner innovative analytical methods and advanced analytical methods, we shall attempt to advance technology in order to analyze at the atomic and molecular levels various phenomena of atomic-energy-use materials, particularly those which occur in a radioactive environment.

Insofar as atomic energy includes "radioactivity," the advancement of technology for the reliability and safety of atomic-energy-use materials is an inevitable task in order to avoid that latent risk. Therefore, we shall develop new monitoring and measuring technology and establish a base for diagnosing materials. In particular, we will develop technology for non-contact measurement and evaluation under high temperatures and heavy irradiation. Furthermore, we shall aim at establishing technology for estimating the life and remaining life of each type of material in a radioactive environment and developing a method of evaluation.

(5) Research and Development Related to the Building of a Database on Atomic-Energy-Use Materials

We shall build and maintain a database on materials used in basic-technology atomic energy by systematizing data and knowledge concerning data required in the material design of radiation-resistant materials, materials for lowering radiation and materials resistant to chemical environments, or data concerning the ultimate performance of materials for the purpose of ensuring the safety of equipment and structures. Here it is necessary to attempt an efficient linking among research facilities, while preserving their individuality, in order to make possible efficient construction of a database and cooperation with non-nuclear fields. Moreover, it is necessary to attempt to establish a system for database management functions. For the future, we aim at making the database intelligent in order to design materials in response to user needs.

3. Efficient Promotion of Development of Materials for Use in Atomic Energy

Atomic energy basic technology is the kind of creative, innovative development of technology which will bring about breakthroughs in the 21st century system of atomic energy technology. It is something which we are trying to promote based on a medium-to-long-term view. In such a situation, even in the development of technology for materials used in atomic energy, regardless of whether it be atomic energy or non-atomic energy, it is demanded that we attempt to promote development of technology by efficiently utilizing the research potential possessed by atomic-energy-related research corporations, national research institutes, universities and the private sector, while respecting the individuality of each facility. As concrete measures, here we took up in particular the effective utilization of large research facilities, international cooperation, and the fostering of persons of talent.

(1) Effective Use of Large Research Facilities

In order to comprehensively and efficiently promote development of technology for materials used in atomic energy, we shall actively promote joint research among research facilities which possess the research potential necessary for development of basic technology. In particular, joint research which possesses large research facilities becomes important. As existing large research facilities, there are such facilities as JRR-3 [Japan Research Reactor No 1] (Japan Atomic Energy Research Institute), Joyo (Power Reactor and Nuclear Fuel Development Corporation), and Microbeam PIXE RBS (Electrotechnical Laboratory). In FY88 construction will begin on equipment for on-the-spot analysis and evaluation of material irradiation damage (National Research Institute for Metals). Moreover, in the future it will also be necessary concerning such new methods as the strong-neutron-irradiation method and advanced testing after irradiation, to have detailed investigation by concerned agencies in regard to such things as the effectiveness and technological tasks of those facilities and their compatibility with the plans of other facilities. In addition, both efficient operation of this kind of facility and active exchange of talented staff will be required in order to promote joint research which uses these large research facilities

(2) International Cooperation

In regard to those things in the development of basic technology for atomic-energy-use materials for which the results will benefit not only Japan but many foreign countries as well, it is necessary to promote such international cooperation as exchange of information and joint research with foreign countries. In particular, development of technology through international cooperation is desired still more accompanying expansion of the scale of development of technology or the kind of expansion of research facilities which cannot be borne by Japan alone.

(3) Fostering of Persons of Talent

As mentioned previously, up to now development of technology for atomic-energy-use materials has been conducted based on the principles and necessities of each individual research facility. However, in the future, in order to develop R&D which will take the lead in technical innovation in a wide domain which includes leading-edge technology, in addition to researchers who have actually participated in development of technology for use in atomic energy, the fostering of persons of talent with superior creativity is demanded. Furthermore, it is desired that we promote exchange of persons of talent among countries, not to mention among industry, academia, and government within Japan.

Nuclear Power Plant Breakdowns, Trouble at Record Low

43062038b Tokyo PUROMETEUSU in Japanese Oct 88 pp 42, 43

[Article: "Nuclear Power Plant Breakdowns and Trouble Are Lowest in History: Amount of Staff Exposure to Radiation Also Decreasing Each Year"]

[Text] In FY87 Japan's nuclear power generation attained an equipment-utilization rate of 77.1 percent, its highest record to date; the main causes for this were

the shortening of the time for periodic inspections and the fact that power-plant stoppages due to such things as accidents and breakdowns decreased.

As though to corroborate this, at 0.5 incidents per reactor, the smallest number of incidents of nuclear power plant breakdown and trouble ever were recorded; and, at 0.17 rem, radiation exposure per staff member also fell below the previous year.

According to a Ministry of International Trade and Industry [MITI] announcement, in FY87 the number of incidents of breakdown and trouble reported to the Agency of Natural Resources and Energy in accordance with law was 19. It is the same number of incidents as that for FY86, but the number of power plants in operation has increased to 35 reactors. Therefore, it worked out to be 0.5 per reactor, the fewest ever.

The breakdown of the 19 incidents is: four cases in which the plant shut down automatically during operation (including adjustment operation because of periodic inspection), seven in which the plant was shut down manually during operation, six cases discovered during periodic inspections, and two other cases. When we classify the cause of breakdown or trouble according to control elements, there were four instances of inappropriate production control, three instances of inappropriate performance control, eight instances of inappropriate maintenance control, and four other instances. In no case was there influence of radioactivity on the areas surrounding nuclear power plants.

Meanwhile, the total volume of radiation exposure suffered by staff of nuclear power plant facilities was 9,482 man-rem, 716 man-rem below the previous fiscal year. The average exposure per person was 0.17 rem, below the 0.18 rem of the previous year, indicating a tendency to decrease each year. This is because such work as inspection and maintenance has been automated and changed to remote manipulation, low cobalt material and corrosion-resistant steel material were employed, the number of welded seams was reduced by enhancement of manufacturing technology, and so on. When we compare the average volume of exposure per employee with the 0.38 rem of FY78, it has declined to less than one-half in the space of 10 years. Therefore, the fruits of light-water reactor advanced technology are vivdly manifest.

Furthermore, in FY87 the number of drums of radioactive solid waste generated by nuclear power plants was 11,358, and this too is about one-fifth of the approximately 54,900 drums of FY81, testifying to the progress of volume-reduction technology. The cumulative volume of drum storage at the end of FY87 was 453,153 drums, and this is approximately 60 percent of the capacity of nuclear power plants' existing storage equipment.

High Level Radioactive Waste Research Proposed

43062021a Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 6 Oct 88 p 1

[Text] Beginning next fiscal year, the Science and Technology Agency is planning to conduct research into nuclide separation/quench treatment as an international research project of the Japanese leadership. Nuclide separation/quench treatment involves research into the novel possibility of reducing high level radioactive waste disposal requirements, turning the usable elements contained within them into resources, and improving active safety. They say that the research will be performed as an international cooperative project of the Organization for Economic Cooperation and Development/Nuclear Energy Agency. The Science and Technology Agency has appropriated approximately ¥500 million for the development of nuclide separation/quench treatment technology.

Nuclide separation/quench treatment is a technique in which the high level radioactive wastes generated by the reprocessing of spent nuclear fuels are separated (nuclide separation) into 1) transuranium (TRU) element groups with long half-lives, 2) strontium and cesium element groups, 3) platinum and technetium element groups, and 4) other fission products, and then converts (quench treats) only the TRU into radioactive nuclides with short half-lives through accelerator proton and electron irradiation and neutron irradiation using an FBR and monofuel combustion furnace.

They say that in disposing of high level radioactive wastes, for example by quenching plutonium 239 (half-life of 24,000 years) and converting it into zirconium 95 (half-life of 64 days) and molybdenum 96 (a nonradioactive nuclide), it is possible to greatly reduce time obligations and space requirements such as the thickness of shielding walls.

The Atomic Energy Commission's Group Separation/Quench Treatment Technology Investigation Committee is studying the matter, will create a draft of a report covering plans for the next ten years, and is scheduled to report to a meeting of radioactive waste policy specialists on 11 October.

Science and Technology Agency will inaugurate a promotion committee after receiving the report to study operational policies which will include what form the cooperation with OECD/NEA should take.

Synchrotron Construction Plans Discussed

43062021b Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 6 Oct 88 p 2

[Text] The Science and Technology Agency [STA], which is pushing ahead with plans for a large-scale synchrotron radiation (SOR) facility, has developed a plan to appropriate a total of approximately ¥2 billion to the Japan

Atomic Energy Research Institute (JAERI) and the Institute of Physical and Chemical Research (IPCR) in next fiscal year's budget, to design the facility and equipment, and to start construction in fiscal year 1990. The cost of constructing the facility will be approximately ¥100 billion. Research and development will progress with JAERI and IPCR each working in their respective specialty fields and STA expects it to become operational in 1995.

When the path travelled by charged particles like electrons and protons is suddenly bent by magnets, the strong light given off at a tangent to this path is synchrotron radiation (SOR). Because this light is very intense, highly directional, and continuous from the infrared/visible to the x-ray domains, application is possible in a wide range of fields.

In specific terms industrial use is also considered possible in areas such as atomic energy in nuclear fusion plasma diagnostics and research into radiation damage mechanisms, in medicine and biotechnology in cancer diagnosis and enzyme synthesis, and in free electron lasers.

The planned facility will have an eight billion electron volt synchrotron and a storage ring 450 meters in diameter.

A synchrotron on an eight billion electron volt scale is larger than originally expected and the increase reflects the good possibility that "the intensity and short wave lengths of the light from this class of synchrotron will be needed to view some of the rare earths which are one of the targets" of the user universities and businesses.

Heretofore, JAERI has performed the elementary research on the beam path analysis, the accelerator system, the vacuum system, the magnets, etc., while IPCR has made progress in basic research into the shape and material qualities of the accelerator tube by developing models. Next year, however, JAERI and IPCR will move on to the work of research on device design, research and development of user systems, the basic design of the facility, etc.

The facility will consist of three parts: linear accelerator (lineac), synchrotron, and storage ring. JAERI will be responsible for the linear accelerator and synchrotron and IPCR will be in charge of the storage ring.

Because there are some areas of the equipment itself and the magnet, vacuum, accelerator technologies which are of great importance as essential technologies, both research organizations are presently exchanging technical information with one another; and during this year, JAERI and IPCR plan to develop topics for joint projects which take aim at the construction of the overall machine.

At this time there are four prefectures which have been formally declared to be in the running as the site for this facility: Iwate (the Iwate Central Industrial Park), Miyagi (Sendai North Central Industrial Park), Mie (Suzuka Sanroku Research Institute City), and Hyogo (Nishi Harima Technopolis). Because of its nature, the site for facility will require that there is a rock base firm enough that the entire facility will stand on it and that there will be no settling of the foundation. Each of the prefectures has already presented data concerning things like topography, surface, and drilling results and the Science and Technology Agency is having the data examined by experts.

Because construction on the machines and buildings for the facility are scheduled to begin in 1990, the STA has decided to "narrow the candidate sites down to the most suitable during this fiscal year."

Neutron Developed for Plasma Diagnostics

43062021c Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 6 Oct 88 p 2

[Text] The Electrotechnical Laboratory has recently been successful in developing a neutron (reference site) to be used in DT [Detrium-Tritium] plasma diagnostics.

With advances in research and development using large-scale tokamak devices such as the TFTR, JET, and JT-60, and with progress in DT implosion tests in laser inertial fusion, a need has developed for highly accurate, highly reliable nuclear fuel plasma diagnosis techniques. Interference/scatter measurement, electron cyclotron radiation measurement, particle line measurement, and spectography are representative of the diagnosis techniques which have been used up to now.

However, under the very severe measurement conditions in nuclear combustion plasmas, the plasma measurement methods developed have been of some use; but the development of a new method which is highly reliable even under nuclear combustion conditions has been long awaited.

To this end several advanced countries have begun work on the research and development of methods which quantitatively determine the action of the neutrons and alpha particles which are reaction products, with the goal of achieving the development of DT nuclear fusion. For some time the neutron measurement method has been recognized as a fairly powerful measurement technique.

The actual measurement objectives of the neutron technique include the total amount of DT neutrons produced and their energy, spatial, and time distributions. Specifically, it is possible to verify the energy break even point (critical condition) by measuring the total amount of DT neutrons generated and plasma ion temperature, an important plasma parameter, can be determined by measuring the energy distribution of the DT neutrons.

Although the neutron measurement method has played an important role in the research and development of existing fission reactors, there is a different range of neutron energies in its utilization in the nuclear fusion field; and with the severe measurement conditions in nuclear combustion plasmas, there are still many technical problems which need to be solved in order to achieve target accuracies.

For this reason one of the greatest problems has been the development of a DT monochromatic neutron (reference site) which would enable sensitivity and energy corrections.

Under these circumstances the Electrotechnical Laboratory has been performing research into DT monochromatic neutron (reference sites).

With the method the Laboratory developed here, they can not only determine the amount of neutron fluence to an accuracy of plus or minus 1-1.5 percent, but they have also verified that neutron monochromality can be increased to within 0.1 percent at half the range of energy values, something considered impossible with existing techniques.

With this set-up, first a deuterium beam accelerated by a maximum energy of 300 keV is injected into an individual tritium target tilted at a 45 degree angle from the beam direction, DT neutrons are generated, and by measuring the attendant alpha particles generated simultaneously by the fixed solid angle method, the amount of neutron fluence is determined with great accuracy to within plus or minus 1-1.5 percent.

The Electrotechnical Laboratory says, "By using this standard site, we will be able to make sensitivity corrections to the measuring devices used in nuclear combustion plasma diagnostics and to accurately measure their characteristic energy resolution. We expect to be able to make a major contribution to the advance of plasma diagnostic techniques using DT neutrons."

Research Into Laser Induced Chemical Reactions Continues

43062021d Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 6 Oct 88 p 5

[Text]According to the Science and Technology Agency, the Japan Atomic Energy Research Institute (JAERI) has begun full scale research into laser induced chemical reactions. The work is a part of the Strategy to Develop Basic Technologies, which was developed by the Japan Atomic Energy Commission. Its purpose is to perform research into the selectivity of chemical reactions induced by laser light alone or by compound irradiation made up of laser light and radiation, to obtain basic data, and to aid the development of laser utilization technologies. The plan is that in the first stage of the research, running through 1990, JAERI will perform basic research into chemical reactions which benefit from the special characteristics of lasers. In the second stage, beginning in 1991, JAERI will initially study mutual element separation using lasers (reprocessing/group separation by salt-free processes) and then microanalysis.

Laser light has a number of characteristics which are excellent for performing research into chemical reactions: 1) Because wave lengths are uniform (monochromality), specific excitation states can be produced in specific atoms and molecules. 2) Because phase is uniform, light energy can be concentrated on a single point in space (high energy density); therefore, atoms and molecules can be excited to extremely high energy states. 3) Because it is possible to oscillate light over nanosecond (one billionth of a second) and picosecond (one trillionth of a second) time periods (short pulse characteristic), high energy densities are obtained in excitation states during initial generation periods.

By using laser light in this way, it will be possible to break new ground in the study of high speed chemical reactions and in research into new chemical reactions. With these results as a foothold, it will also enable us to hope for new progress in methods for the mutual separation of elements, methods for analyzing microelements, etc.

JAERI's research will consist principally of 1) research into high speed chemical reactions, 2) research into laser selective excitation reactions, and 3) research into high energy density reactions and they will work on obtaining the basic data needed to develop laser utilization techniques.

JAERI's initial studies this year will use simultaneous irradiation by dual wave length n second lasers to gather high speed reaction data on element selective two stage excitation states.

Last year JAERI established a laser-induced chemical reaction installation and this year it will use the equipment to excite various lanthanoid and actinoid ions in solution using an ultraviolet pulse laser (five electron volts) and thus seek high speed data on each of the oxidation/reduction reactions. Because the absorption spectrums for the various ions overlap at wave length domains greater than five electron volts, selective element separation will not necessarily be easy in the future.

Therefore, for next year and therafter, JAERI has decided to study the first stage selective excitation of various elements using color element lasers (YAG lasers used for pumping) in the visible domain (1-3.5 electron volts), while simultaneously studying excitation to orders necessary for oxidation/reduction reactions using 3.5 or 4 volt excimer lasers. JAERI will then apply this data to selective element separation.

Project Will Study the Collection of Fusion Fuel on the Moon

43062021e Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 6 Oct 88 p 5

[Excerpts] In mid-October the Future Engineering Research Institute began "an research project concerning bases on the moon's surface and the development of lunar resources."

As this research study turns its attention to lunar bases and the development of lunar resources, subjects which have recently received attention as the frontiers of the twenty-first century, its purpose will be to further stimulate not only rocket and space engineering, but also a wide range of related technologies like biotechnology, geology, mining, and energy technologies like atomic energy and nuclear fusion.

The research group will thus be a multi-client cooperative project, and it is calling for broad participation by businesses, research organizations, etc.

The group says that at this point universities and twenty related manufacturers in areas like steel, heavy industry, electrical machninery, and construction have announced their participation, as well as research organizations like the National Aeronautical Laboratory, the National Space Development Agency, the Institute of Space and Astronautical Science, the Agency of Industrial Science and Technology, the Japan Atomic Energy Research Institute, the Power Reactor and Nuclear Fuel Development Corporation, Nagoya University's Plasma Research Center, Osaka University's Laser Fusion Research Center, etc.

One area which is of special interest to these groups is the fact that the lunar surface contains enormous amounts of helium 3, considered to be an outstanding material for nuclear fusion.

The helium 3 has been deposited in sand and rocks on the lunar surface by solar wind, and the amount existent on the lunar surface is projected to be more than one million tons.

The group says that if effective use could be made of this, it could become an important energy source in the twenty-first century; but the possibilities are still unknown. [passage omitted]

Furthermore, the various substances like hydrogen and water obtained as by-products of collecting the helium 3 are receiving attention as essentials to maintaining life in lunar bases and space stations.

According to Mr. Kanzaki of the Future Engineering Research Institute, in nuclear fusion using helium 3 and deuterium, energy is released in the form of protons as well as neutrons. For this reason he says that in DT nuclear fusion with direct generation of electricity using charged particles, generation efficiencies of greater than 70 percent can be expected by keeping the amount of DT fusion neutrons to less than one percent and by taking advantage of the essential characteristics of fusion plasmas, subjects which have become major engineering problems. This will therefore be one of this study's major topics concerning the development of lunar resources.

The project will study major points by forming a subcommittee to coordinate the direction of the overall project and a subcommittee to study technical problems and design for the lunar resource factory system, together with a subcommittee to work on conceptual design and feasibility analysis for the generation of electricity using deuterium/helium 3 nuclear fusion.

The conceptual study of the deuterium/helium 3 fusion reactor will be lead by Professor Momota of Nagoya University's Plasma Research Center and Professor Nakai of Osaka University. The group will evaluate the possibilities of a number of concepts, beginning with inertial confinement methods and magnetic confinement methods like FRC. The group will also make general evaluations on conceptual designs which make full use of the advantages of direct power generation, on the overall economic features of fusion generating systems using the moon's helium 3 resources, and on the definition of technical problems. The group will also include atomic reactors for space use and will investigate the possibility of using them for energy supply on the moon and as propulsion mechanisms for earth/moon orbital transporters. As the studies progress, the group will promote tangible work by establishing work groups through the cooperation and collaboration of the universities and research organizations.

In the future the group will continue the work of each of the subcommittees and perform evaluations on each of the topics for research. By September, 1990 the group is scheduled to complete the overall developmental concept, include developmental problems, and to present a proposal to the government's Space Activities Commission, Atomic Energy Commission, etc.

R&D Trends in Industry Assessed

3698m051 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN, in German No 488, 30 Sep 88 pp 13-14

[Excerpts] With a yearly investment of over ¥9 billion, Japan's research and development expenditure exceeds that of every other Western country except the United States. However the public sector share, amounting to about 21 percent, is clearly below that of the FRG (37 percent) or the United States (47 percent). Private enterprise accounts for approximately two-thirds of total R&D spending, private and state universities for 20 percent, and private and state research institutes for a mere 14 percent. These figures show how crucial industrial R&D activities are to Japan's technical development.

From an analysis of expenditures for research and development in various industrial sectors it appears that the electronics industry—with the emphasis on electronics—is well ahead of the rest. Firms in this sector account for nearly a third of all industrial R&D investment. By contrast, until 20 years ago the chemical industry still held the lead with a 25 percent share. However for many years the pharmaceutical industry has ranked first in research intensity. While the ratio of average research spending to turnover in the electrical sector is about 5 percent, in the pharmaceutical industry it has reached the unusually high ratio of 7 percent.

Marked differences between the individual branches of industry also emerge when R&D spending is broken down into basic research and applied R&D. The Japanese economy is accused of neglecting basic research, yet over the past 10 years its share of total R&D investment has grown considerably in several industrial sectors. This applies particularly to those companies engaged in the fields of biotechnology and new materials, with the result that of the overall figure spent on R&D, basic research accounted for approximately 17 percent of the resources invested in the pharmaceutical industry and 11 percent in the foodstuffs industry. The percentage spent on basic research in the electrotechnical engineering sector has, however, dwindled to a mere 3 percent. In this sector the emphasis has been placed on applied research and development.

Nevertheless the classification by industrial sectors mentioned above provides a rather distorted picture, as many firms are now expanding beyond their traditional areas of business as a result of restructuring and diversification. Japanese producers of paints and dyes or building contractors, for example, are now conducting biotechnology research projects, while companies working in the steel sector are engaged in semiconductor research. In the management policy of individual companies, with particular regard to price definition, the amortization of long-term R&D investment becomes more important than covering current production costs—an international trend typical, for example, of the pharmaceutical industry. The risk of mistaken investments in R&D thus also tends to increase.

On the one hand, in many research sectors the initial investment currently required to ensure the successful completion of projects from an economic point of view is already very high, and extremely high in the case of semiconductor and genetic engineering research. On the other hand, these initial costs make it very difficult to interrupt a project once it is underway. This leads to growing expenditures year after year in the hope that the project may be successfully completed. In this way R&D expenditures may generate dangerous dynamics and become difficult to control.

Another problem facing research and development in Japanese industry is to be found in the area of international technology transfer. As the Japanese economy has developed technologically, it has become increasingly difficult to import adequate technology from abroad. At the same time, despite all efforts basic research within the country has not kept pace with these developments, with the result that Japanese enterprises tend to transfer part of their R&D work abroad. A welcome internationalization of Japanese research may well be the consequence of all this, although the risk of further weakening basic research in the country cannot be discounted.

Despite these problems, Japan's research and development—and consequently its industry—will certainly retain its position on the international scene in the future. This is all the more true since those concerned in government, scientific, and economic circles agree that the country's commitment to basic research must be intensified.

Business To Expand Use of Communication Satellites

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[Text] This year will see private communication satellites launched for the first time in Japan, and satellite-related businesses will be busy starting up in full scale. A total of four private communication satellites will be launched this year, beginning with Japan's first private communication satellite JCSAT-1 set for launching in February, using the European Ariane rocket. The utilization of state- and NTT-owned CS communication satellites is oalso spreading, and the era of full-scale commercialization of satellites may be said to have started.

The private communication satellites to be launched this year belong to two companies established by large general trading companies 3 years ago. With the first launching set for next month, this company [video in subtitle shows the name of the company as being Japan Communications Satellite] has completed installation of a satellite control center and is now in the final adjustment stage of preparations. This company will launch two satellites, each of which will be equipped with 32 sets of relay apparatuses. Charging ¥500 million for the services of each relay apparatus for a year, the company has succeeded in securing customers for 35 sets of the relay apparatus.

[Begin recorded remarks of Yo Kamiya, president of Japan Communications Satellite] I call this year the beginning year of communication satellites, and I think it will be a significant year because privately based satellite business will start this year. It is said that Japan is faced with trade friction problems and therefore must undergo structural reform. The reform is in progress now, but I think that satellites can be a great means to accelerate the reform. [end recording]

Enterprises planning to use the services of communication satellites vary. This company [video shows offices of an unidentified company] is selling second-hand cars to 2,000 second-hand car dealers in the country. At present, its car dealers are negotiating prices of cars based on pictures sent to their terminals via laser discs, but in the future sales negotiations can be done on an auction basis with the car dealers connected simultaneously via satellites.

This is a large prep school in Tokyo [video shows the school building and its interior]. It already has a large antenna system installed for communications via satellites. The school plans to broadcast live classes by well-known instructors in Tokyo to 23 branch schools throughout the nation using satellites.

There are also companies which want to use satellite communications for conferences and company employee education. The full-scale use of satellite communications can provide momentum in invigorating business activities and in bringing further changes to the people's way of life.

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5285 PORT ROYAL RD
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